

What is claimed is:

1 1. A program information transmission apparatus that repeatedly
2 transmits program information with a predetermined cycle,
3 comprising:

4 a storing unit operable to store information showing
5 a transmission amount per unit time, the unit time being shorter
6 than the cycle;

7 a fetching unit operable to fetch the program information
8 in parts so that each fetched part of the program information
9 has a size within the transmission amount per unit time; and

10 a transmission unit operable to sequentially transmit
11 each fetched part of the program information.

1 2. The program information transmission apparatus of Claim
2 1,

3 wherein the information in the storing unit shows,
4 as the transmission amount per unit time, a maximum number
5 of packets that should be transmitted per unit time, and

6 the fetching unit includes:

7 a packet generating unit operable to generate a plurality
8 of packets of a fixed length from program information sets,
9 each of which includes a part of the program information;

10 a holding unit operable to hold the plurality of packets
11 so that packets belonging to different program information
12 sets are held in different queues; and

13 a packet fetching unit operable to fetch the plurality
14 of packets from the queues in a predetermined order so that
15 a number of packets fetched per unit time does not exceed the
16 maximum number.

1 3. The program information transmission apparatus of Claim
2 2,

3 wherein packets generated from one program information
4 set is divided into at least one section, and

5 the packet fetching unit is controlled to fetch all
6 packets in a current section before fetching packets in another
7 section.

1 4. The program information transmission apparatus of Claim
2 3 further comprising:

3 a calculation unit operable to recalculate the maximum
4 number, each time at least one program information set is updated
5 or is newly registered,

6 wherein the calculation unit includes:

7 a first calculation unit operable to calculate a maximum
8 number for each program information set from a data amount
9 of the program information set and the cycle, each maximum
10 number calculated for one program information set being a maximum
11 number of packets of the program information set that should
12 be transmitted per unit time; and

13 a second calculation unit operable to calculate a total

14 of the maximum numbers calculated by the first calculation
15 unit,
16 wherein the information in the storing unit is
17 overwritten with the total calculated by the second calculation
18 unit.

1 5. The program information transmission apparatus of Claim
2 4,

3 wherein each program information set is assigned a
4 priority, and

5 the packet fetching unit fetches the plurality of packets
6 from the queues according to the priorities assigned to the
7 program information sets.

1 6. The program information transmission apparatus of Claim
2 5,

3 wherein the storing unit also stores each maximum number
4 calculated by the first calculation unit, and

5 the packet fetching unit includes:

6 a cumulative calculation unit operable to, after the
7 packet fetching unit fetches the last packet of a current section
8 in an "n"th transmission period, calculate a cumulative number
9 for a program information set including the current section
10 by multiplying the maximum number for the program information
11 set by "n", each transmission period being a period within
12 the cycle and having a length of the unit time, the cumulative

13 number being a number of packets of the program information
14 set that should be transmitted by an end of the "n"th transmission
15 period; and

16 a selecting unit operable to, if a number of hitherto
17 fetched packets of the program information set is at least
18 equal to the cumulative number, select another program
19 information set assigned a next higher priority as a program
20 information set whose packets are to be fetched.

1 7. The program information transmission apparatus of Claim
2 3 further comprising:

3 an input receiving unit operable to receive an input
4 of immediate program information that should be urgently
5 transmitted;

6 a prohibiting unit operable to prohibit, if immediate
7 program information is inputted, the packet fetching unit from
8 fetching packets;

9 a second packet generating unit operable to generate
10 a plurality of packets of a fixed length from the inputted
11 immediate program information;

12 a transmission control unit operable to control the
13 transmission unit to sequentially transmit all of the packets
14 generated by the second packet generating unit; and

15 a prohibition ending unit operable to instruct, after
16 all of the packets generated by the second packet generating
17 unit are transmitted, the prohibiting unit to end the prohibition.

18 operation.

1 8. The program information transmission apparatus of Claim
2 7,

3 wherein the prohibiting unit waits for all packets
4 of a section, which includes a packet fetched immediately before
5 the immediate program information was inputted, to be fetched
6 before starting the prohibition operation.

1 9. The program information transmission apparatus of Claim
2 2 further comprising:

3 an input receiving unit operable to receive an input
4 of immediate program information that should be urgently
5 transmitted;

6 a prohibiting unit operable to prohibit, if immediate
7 program information is inputted, the packet fetching unit from
8 fetching packets;

9 a second packet generating unit operable to generate
10 a plurality of packets of a fixed length from the inputted
11 immediate program information;

12 a transmission control unit operable to control the
13 transmission unit to sequentially transmit all of the packets
14 generated by the second packet generating unit; and

15 a prohibition ending unit operable to perform, after
16 all of the packets generated by the second packet generating
17 unit are transmitted, packet transmission adjustment for a

18 number of transmitted packets exceeding the maximum number
19 of packets that should be transmitted per unit time, before
20 instructing the prohibiting unit to end the prohibition
21 operation.

1 10. The program information transmission apparatus of Claim
2 9,

1 wherein the prohibiting unit waits for all packets
2 of a section, which includes a packet fetched immediately before
3 the immediate program information was inputted, to be fetched
4 before starting the prohibition operation, and

5 the prohibition ending unit waits for a number of packets,
6 whose transmission is refrained after all packets generated
7 by the second packet generating unit are transmitted, reaches
8 a number of transmitted packets exceeding the maximum number
9 of packets that should be transmitted per unit time, before
10 instructing the prohibiting unit to end the prohibition
11 operation.

1 11. A program information transmission apparatus that
2 repeatedly transmits program information with a predetermined
3 cycle, comprising:

4 a storing unit operable to store information showing
5 a maximum number for each transmission period that is a period
6 within the cycle and has a length of a unit time shorter than
7 the cycle, each maximum number for one transmission period

8 being a number of packets that should be transmitted in the
9 transmission period;

10 a packet generating unit operable to generate a plurality
11 of packets of a fixed length from program information sets,
12 each of which includes a part of the program information;

13 a holding unit operable to hold the plurality of packets
14 so that packets belonging to different program information
15 sets are held in different queues;

16 a fetching unit operable to fetch the plurality of
17 packets from the queues in a predetermined order so that a
18 number of packets fetched in each transmission period does
19 not exceed the maximum number for the transmission period;

20 a transmission unit operable to sequentially transmit
21 each fetched packet;

22 a calculation unit operable to recalculate each maximum
23 number, each time at least one program information set is updated
24 or is newly registered,

25 wherein the calculation unit includes:

26 a first calculation unit operable to divide a data
27 amount of each program information set by a number of transmission
28 periods within the cycle and set a division result obtained
29 for each program information set as an average number for the
30 program information set without rounding up or discarding a
31 fractional portion of the division result, each average number
32 for one program information set being a number of packets of
33 the program information set that should be transmitted per

34 unit time;

35 a second calculation unit operable to calculate, for
36 each program information set, a cumulative number of packets
37 of the program information set that should be transmitted by
38 an end of an "n"th transmission period by multiplying the average
39 number for the program information set by "n";

40 a third calculation unit operable to total the cumulative
41 numbers calculated by the second calculation unit; and

42 a fourth calculation unit operable to calculate the
43 maximum number for the "n"th transmission period from the total
44 calculated by the third calculation unit,

45 wherein the information in the storing unit is
46 overwritten with the maximum number calculated by the fourth
47 calculation unit.

1 12. The program information transmission apparatus of Claim
2 11,

3 wherein the second calculation unit adds a predetermined
4 positive value that does not exceed one to each average number,
5 sets each addition result as a new average number, multiplies
6 each new average number by "n", obtains an integer by rounding
7 up each multiplication result, and sets each integer as one
8 cumulative number.

1 13. The program information transmission apparatus of Claim
2 11,

3 wherein packets generated from one program information
4 set is divided into at least one section, and

5 the packet fetching unit is controlled to fetch all
6 packets in a current section before fetching packets in another
7 section.

1 14. The program information transmission apparatus of Claim
2 11,

3 wherein each program information set is assigned a
4 priority, and

5 the packet fetching unit fetches the plurality of packets
6 from the queues according to the priorities assigned to the
7 program information sets.

1 15. The program information transmission apparatus of Claim
2 14,

3 wherein the storing unit also stores each cumulative
4 number calculated by the second calculation unit, and

5 after fetching the last packet of a current section
6 in the "n"th transmission period, the packet fetching unit
7 refers to the information in the storing unit and, if a number
8 of hitherto fetched packets of a program information set
9 including the current section is at least equal to the cumulative
10 number for the program information set, selects another program
11 information set assigned a next higher priority as a program
12 information set whose packets are to be fetched.

1 16. The program information transmission apparatus of Claim
2 11 further comprising:

3 an input receiving unit operable to receive an input
4 of immediate program information that should be urgently
5 transmitted;

6 a prohibiting unit operable to prohibit, if immediate
7 program information is inputted, the packet fetching unit from
8 fetching packets;

9 a second packet generating unit operable to generate
10 a plurality of packets of a fixed length from the inputted
11 immediate program information;

12 a transmission control unit operable to control the
13 transmission unit to sequentially transmit all of the packets
14 generated by the second packet generating unit; and

15 a prohibition ending unit operable to instruct, after
16 all of the packets generated by the second packet generating
17 unit are transmitted, the prohibiting unit to end the prohibition
18 operation.

1 17. The program information transmission apparatus of Claim
2 16,

3 wherein the prohibiting unit waits for all packets
4 of a section, which includes a packet fetched immediately before
5 the immediate program information was inputted, to be fetched
6 before starting the prohibition operation.

1 18. The program information transmission apparatus of Claim
2 11 further comprising:

3 an input receiving unit operable to receive an input
4 of immediate program information that should be urgently
5 transmitted;

6 a prohibiting unit operable to prohibit, if immediate
7 program information is inputted, the packet fetching unit from
8 fetching packets;

9 a second packet generating unit operable to generate
10 a plurality of packets of a fixed length from the inputted
11 immediate program information;

12 a transmission control unit operable to control the
13 transmission unit to sequentially transmit all of the packets
14 generated by the second packet generating unit; and

15 a prohibition ending unit operable to perform, after
16 all of the packets generated by the second packet generating
17 unit are transmitted, packet transmission adjustment for a
18 number of transmitted packets exceeding the maximum number
19 for the "n"th transmission period, before instructing the
20 prohibiting unit to end the prohibition operation.

1 19. The program information transmission apparatus of Claim
2 18,

3 wherein the prohibiting unit waits for all packets
4 of a section, which includes a packet fetched immediately before

5 the immediate program information was inputted, to be fetched
6 before starting the prohibition operation; and
7 the prohibition ending unit waits for a number of packets,
8 whose transmission is refrained after all packets generated
9 by the second packet generating unit are transmitted, reaches
10 a number of transmitted packets exceeding the maximum number
11 for the "n"th transmission period, before instructing the
12 prohibiting unit to end the prohibition operation.

1 20. A program information transmission method of repeatedly
2 transmitting program information with a predetermined cycle,
3 comprising:

4 a packet generating step for generating a plurality
5 of packets of a fixed length from program information sets,
6 each of which includes a part of the program information;

7 a holding step for holding the plurality of packets
8 so that packets belonging to different program information
9 sets are held in different queues;

10 a packet fetching step for fetching, in each transmission
11 period that is a period within the cycle and has a length of
12 a unit time shorter than the cycle, the plurality of packets
13 from the queues in a predetermined order so that a number of
14 packets fetched in each transmission period does not exceed
15 a maximum number of packets that should be transmitted in the
16 transmission period; and

17 a transmission step for sequentially transmitting each

18 fetched packet.

1 21. The program information transmission method of Claim 20,
2 wherein packets generated from one program information
3 set is divided into at least one section, and
4 the packet fetching step is controlled to fetch all
5 packets in a current section before fetching packets in another
6 section.

1 22. The program information transmission method of Claim 21,
2 wherein each program information set is assigned a
3 priority, and
4 the packet fetching step fetches the plurality of packets
5 from the queues according to the priorities assigned to the
6 program information sets.

1 23. The program information transmission method of Claim 22,
2 wherein the packet fetching step includes:
3 a cumulative calculation step for calculating, after
4 the packet fetching step fetches the last packet of a current
5 section in an "n"th transmission period, a cumulative number
6 for a program information set including the current section
7 by multiplying "n" by a predetermined maximum number of packets
8 of the program information set that should be transmitted per
9 unit time, the cumulative number being a number of packets
10 of the program information set that should be transmitted by

11 an end of the "n"th transmission period; and
12 a selecting step for selecting, if a number of hitherto
13 fetched packets of the program information set is at least
14 equal to the cumulative number, another program information
15 set assigned a next higher priority as a program information
16 set whose packets are to be fetched.

1 24. A program information transmission method comprising:

2 a receiving step for receiving an input of a program
3 information set;

4 a judging step for judging whether the inputted program
5 information set needs to be urgently transmitted;

6 a packet generating step for generating a plurality
7 of packets of a fixed length from the inputted program information
8 set;

9 a holding step for holding each packet in a queue,
10 if the inputted program information set does not need to be
11 urgently transmitted, packets generated from different program
12 information sets being held in different queues; and

13 a transmission control step for (1) until a program
14 information set that needs to be urgently transmitted is inputted,
15 fetching and transmitting each packet held in a queue in a
16 predetermined order so that a number of packets fetched and
17 transmitted in each predetermined period does not exceed a
18 maximum number of packets that should be transmitted in the
19 predetermined period, and (2) if a program information set

20 that needs to be urgently transmitted is inputted, terminating
21 a transmission of each packet in a queue and sequentially
22 transmitting all packets generated from the program information
23 set that needs to be urgently transmitted.

1 25. A computer-readable recording medium which records a program
2 information transmission program that has a computer execute
3 a procedure for repeatedly transmitting program information
4 with a predetermined cycle,

5 the program information transmission program
6 comprising:

7 a packet generating step for generating a plurality
8 of packets of a fixed length from each program information
9 set that includes a part of the program information;

10 a holding step for holding each packet in a queue so
11 that packets generated from different program information sets
12 are held in different queues;

13 a fetching step for fetching, in each transmission
14 period that is a period within the cycle and has a length of
15 a unit time shorter than the cycle, each packet from a queue
16 in a predetermined order so that a number of packets fetched
17 in each transmission period does not exceed a maximum number
18 of packets that should be transmitted in the transmission period;
19 and

20 a transmission step for sequentially transmitting each
21 fetched packet.